Fujitsu Semiconductor Europe
User Manual

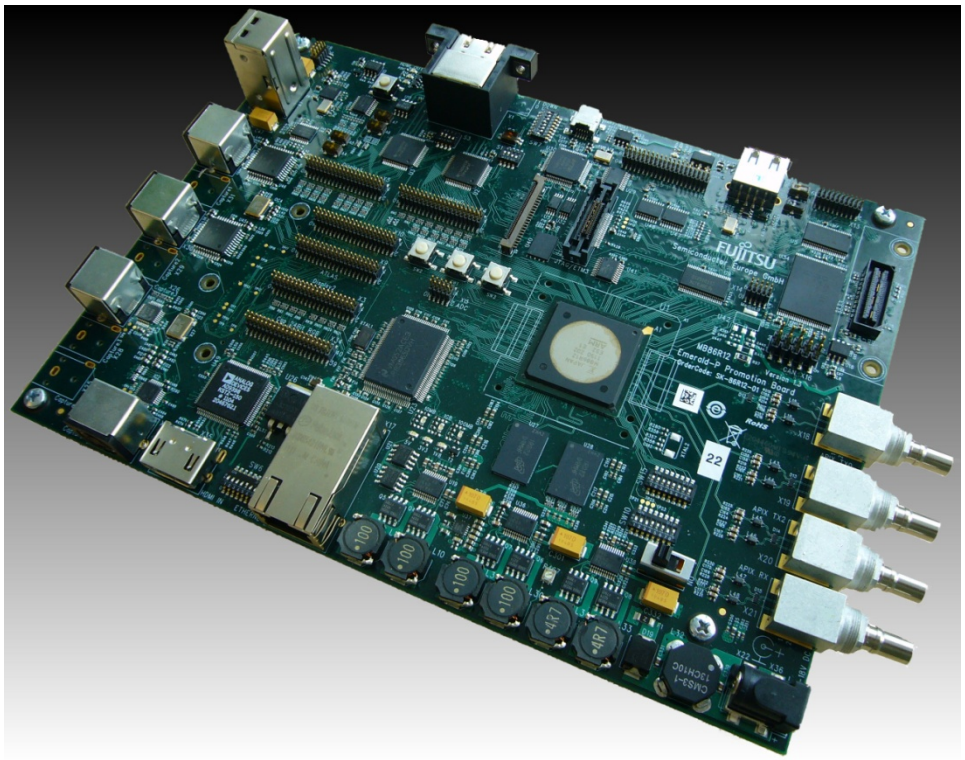
FSEUGCC-UM_SK-86R12-01_Rev1.4

EMERALD-P

PROMOTION BOARD

SK-86R12-01

USER MANUAL



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Revision History

Date	Issue
15.10.2012	Rev1.4 Andy von Treuberg Added Note that Ethernet Interface is not usable in WAV configuration due to pin multiplexing.
21.05.2012	Rev1.3 Andy von Treuberg Changed default settings of SW15. Changed references to schematic (now Rev1.7)
08.05.2012	Rev1.2 Andy von Treuberg Complete rework of content.
16.04.2012	Rev1.1 Herbert Hönig Updated JTAG Settings (Core Voltages, Switches)
02.02.2012	Rev1.0 Herbert Hönig Added pictures
13.01.2012	Rev0.1 Herbert Hönig First draft

This document contains 42 pages.

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1 Introduction

1.1 System Features

This section provides an overview of the features of the SK-86R12-01 (Emerald-P Promotion Board).

- 2x RS232 interfaces via FTDI USB serial converter (USB to RS232)
- HOST SPI interface via FTDI USB serial converter (USB to HOST SPI)
- CAN interface (Pin header 2.54 mm)
- Media LB interface 3 pin (Pin header 1.27 mm)
- MOST interface connector for SMSC PHY + Modules
- AIC / IPC interface (designed to work with Fujitsu ATLAS/Calypso MCU boards)
- DDR3 DRAM 2x 2GBit (512 MByte)
- NOR Flash 16 bit or 32 bit usable (2 GBit)
- NAND Flash 16 bit length (2 GBit)
- Quad SPI Flash (128 MBit) on board
- Ethernet (internal MAC of Emerald used, external PHY) 10/100 MBit Configuration
- 1x USB Host
- JTAG debugger connector (38 pin Mictor Connector) (20 pin, 2.54 mm pitch adapter available)
- SD card interface
- 3x APIX TX interfaces (3 Gbit)
- 1x APIX RX interface (3 Gbit)
- 4x cinch (YUV) and 4x S-Video connectors for video input
- HDMI video capture input (RGB888)
- 2x HDMI video output (RGB888)
- 1x FFC video output (RGB666) with touch controller (for the direct connection of Glyn EDT display family devices)
- 3x video output on pin header 1.27mm pitch (RGB888)
- 3x user buttons and 3x user LEDs (programmable via GPIOs)
- Sound line input / line output
- Connector for SK-86R12-WAV01 (add-on board for digital 360° wrap around view cameras)

Most of the interfaces can be accessed separately via control switches on the board. This makes it possible to use all the multiplex modes that MB86R12 'Emerald-P' provides.

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1.2 Mechanical Dimensions

- PCB (components not mounted): 200 x 150 mm
- Dimensions with mounted connectors: 220 x 150 mm
- Height (with spacing bolts): 40 mm

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2 Information and Support on the Internet

The functional details of the MB86R12 'Emerald-P' device can be found in the latest Hardware Manual, which can be downloaded from the following location:

http://www.fujitsu.com/emea/services/microelectronics/gdc/gdcdevices/mb86r12-emerald-p.html (select the 'Support' tab).

For support and downloads concerning the SK-86R12-01 board, please refer to the following locations:

http://www.fujitsu.com/emea/services/microelectronics/gdc/evalbds/emerald-p-promotionboard.html (select the 'Support' tab) or

http://www.fujitsu.com/emea/services/microelectronics/gdc/evalbds/wraparound-starterkit.html (select the 'Support' tab).

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3 System Overview

The Emerald-P Promotion Board itself is a complete evaluation system, but there are also two optional extras that can be used in conjunction with the Promotion Board to build a system for specific application development.

- Emerald-P Promotion Board (SK-86R12-01)
- Optional extra: SK-86R12-WAV01 (add-on board for digital 360° wrap around view providing 4x digital camera support)
- Optional extra: MOST add-on Board (SMSC PHY+ series)

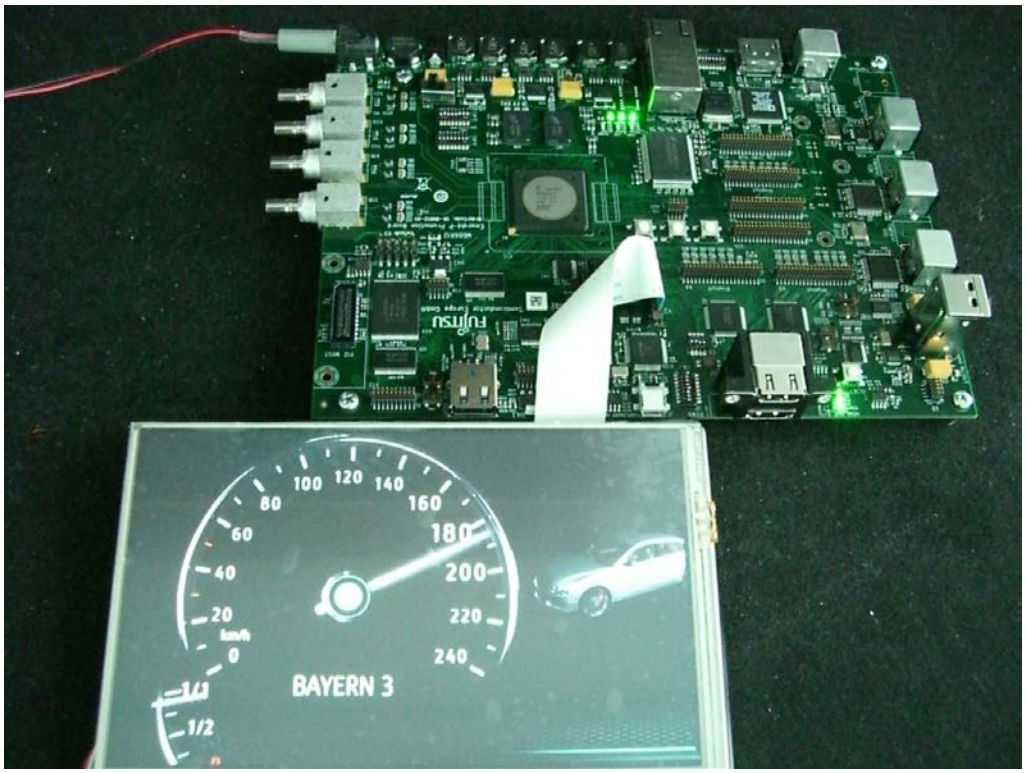

Figure 3-1: System Overview

The Emerald-P Promotion Board is also a part of the 360° Wrap Around View product and is therefore also covered in this guide.

4 Quickstart

Before powering up the board, please ensure that

- you have a DC power supply that can deliver a voltage in the range 9 ... 18V (12V recommended) at max. 1.5A. The inner pin has to be connected to positive (+), the outer ring has to be connected to ground (-). A suitable power supply can also be delivered by Fujitsu (please contact your Fujitsu Sales Representative if required).
- all the switch settings on the board (e.g. pin multiplex settings, interfaces to be used) are correct for your application. The default settings of the switches are described in this document.

To bring the system into operation quickly, execute the following steps:

- Install the drivers for the FTDI components on your board, either by obtaining the latest version from the FTDI website* or from the WAV Tools DVD (e.g. E:\Driver\CDM 2.08.24 WHQL Certified)

  * http://www.ftdichip.com/Drivers/VCP.htm
  http://www.ftdichip.com/Support/Documents/InstallGuides.htm

- Connect a mini USB cable to J1 and the other end to your PC.
  The SK86R12-01 Promotion Board will be automatically recognized and four new COM ports will be installed as follows:
  - 'USB Serial Converter A': can be used as the HOST SPI interface
  - 'USB Serial Converter B': can be used as an I2C interface direct to devices
  - 'USB Serial Converter C': can be used as the UART0 interface
  - 'USB Serial Converter D': can be used as the UART4 interface

  Note that Windows may not use exactly these names, however, the **third COM port** installed is the one that is required for the next installation step.
- Start a terminal program such as Tera Term (http://ttssh2.sourceforge.jp) with the following configuration:
  - Baud rate: 115.200 bps
  - Data: 8 bits
  - Stop bit: 1 bit
  - Parity: none
  - Flow Control: none
- Connect the terminal program to port: 'USB Serial Converter C'
- Connect an HDMI cable to X1 (use the **upper** HDMI port of the connector - which is Display 0). Connect the other end of the cable to a TFT monitor that supports DVI and a resolution of 800 x 480 pixels (virtually any modern TFT monitor will support this mode).
- Connect the external DC power supply to X22 (at 12V a current of around 600 mA will be needed in power up mode)
- Switch on your SK86R12-01 Promotion Board using switch SW9 (large switch on the bottom right-hand corner of the PCB), and check that LEDs D6, D7 and D8 light up.

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- After the board has powered up, the embedded Linux operating system is started and a demonstration program will be run (this can take a number of seconds). Please monitor the messages in the terminal console window for any errors or warnings.
- After the system has completed booting, a dashboard demonstrator will be shown on the display.

```
Trying to mount an usb-memory device for 10 seconds [    7.020000] isp1760 isp17
60.0: port 1 high speed
[    7.080000] usb 1-1: new high speed USB device number 2 using isp1760
[    7.140000] isp1760 isp1760.0: port 1 high speed
[    7.220000] usb 1-1: New USB device found, idVendor=0471, idProduct=3526
[    7.220000] usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=0
[    7.230000] usb 1-1: Product: ISP1520
[    7.230000] usb 1-1: Manufacturer: Philips Semiconductors
[    7.240000] hub 1-1:1.0: USB hub found
[    7.240000] hub 1-1:1.0: 3 ports detected
Unable to mount an usb-memory device

start demonstration
[   16.960000] init_module(Apr  4 2012, 11:41:20)
[   16.960000] init_module: Mapped vram area @96000000 phys:90000000 size:256MB
Resolution 800 x 600
Enter: Close
1: small/big left tube
2: right tube on/off
a: antialiasing on/off
m: motion blur on/off
f: show frames per second on/off
e: toggle engine mode
```

Figure 4-1: Console output

Figure 4-2: Running Demo

5 About U-Boot

The U-Boot utility is an embedded program that handles the basic configuration of the MB86R12 device, boots the Linux operating system and provides a communication interface to the user. Assuming the physical connection has been made from the PC (USB interface) to the SK86R12-01 (USB) and the board has been self-installed (creating a new virtual COM ports, e.g. for communication), the U-Boot program presents itself to a user via a terminal program link which uses the **third** new virtual COM port (may be named 'USB Serial Converter C').

To stop U-Boot loading the demonstration program, press any key on your keyboard (quickly) after a board reset (SW4) or power on (SW9).

Using specific commands, the configuration of the MB86R12 can be queried ('`printenv`' command on the command prompt of the terminal program) and configured (using the '`setenv`' command). To set up a new pin multiplex configuration for example, check the values returned for the pinmux and pinmux2 environment variables using the command `printenv` on the command line prompt, then change the configuration using (for example):

```
setenv pinmux 84000000
setenv pinmux2 00000000
saveenv
```

The U-Boot utility is described in detail in the documentation provided with the SK86R12-01 board. Please check the 'Software Development Platform' document (at the time this User Manual was written, this document was named

um-MB86R11-SoftwareDevelopmentPlatform.pdf

and was located in the root folder of the downloadable Linux BSP (UpdateHost_v3.2.0.zip).

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6 Board Layout

In the standard delivery form, the board's layout is as shown in the diagram below.

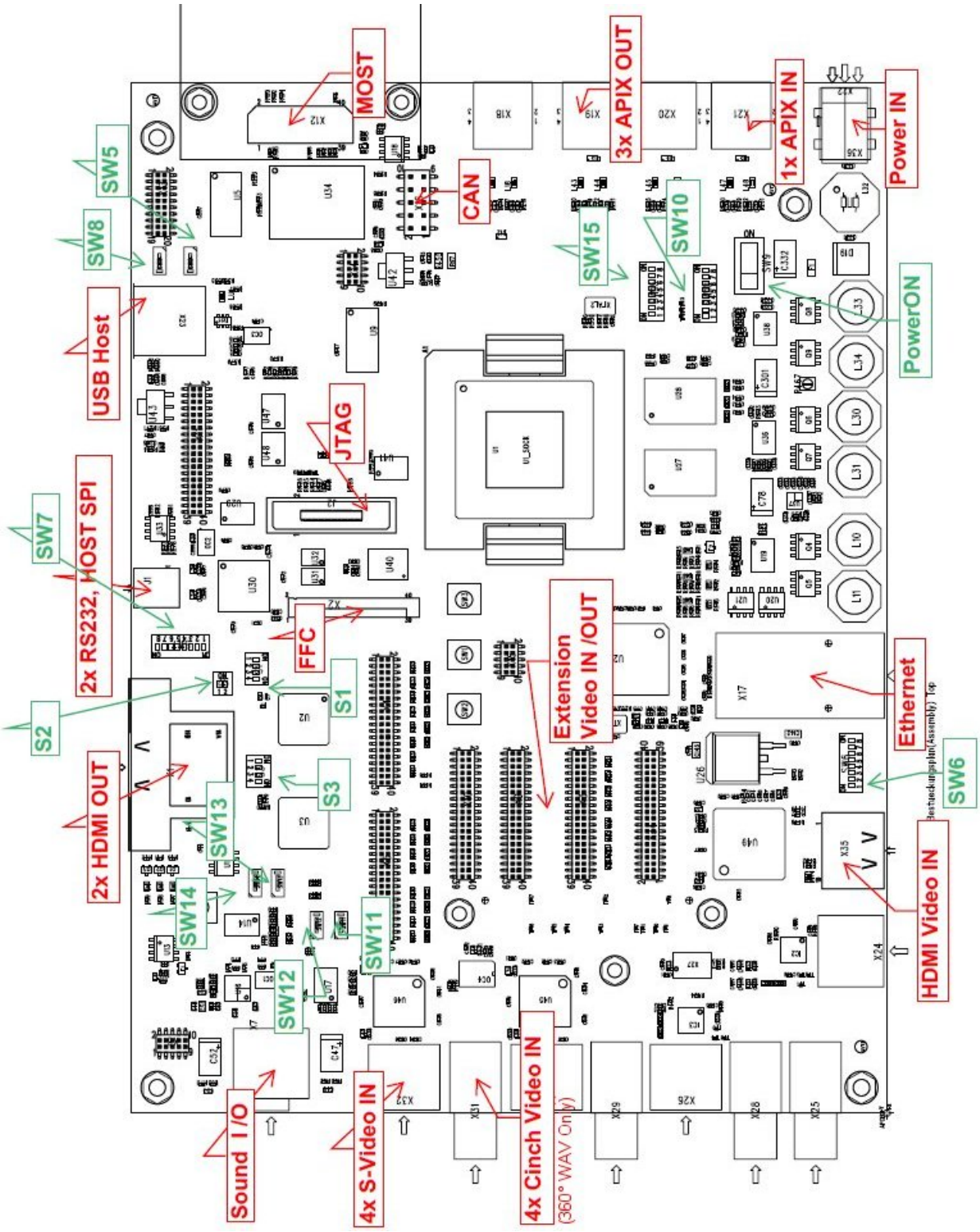

Figure 6-1: Standard Board Layout/Assembly

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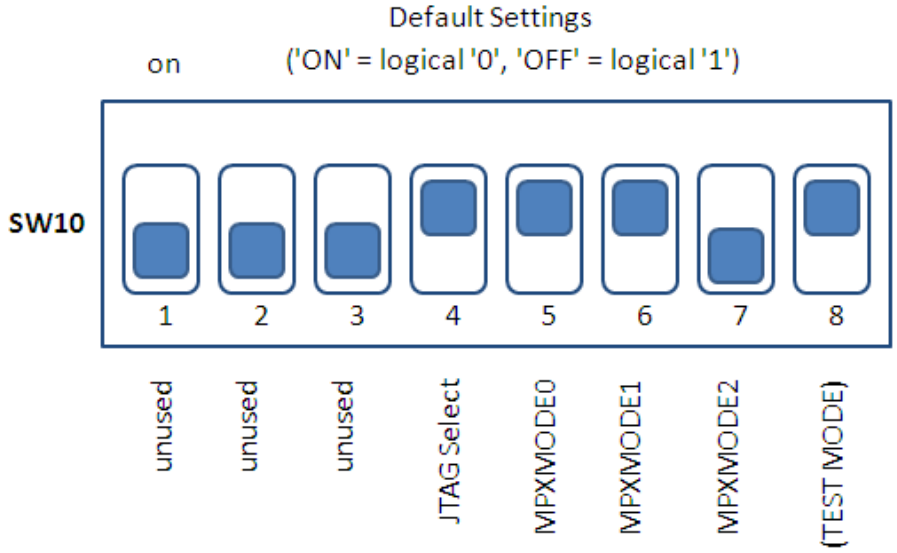
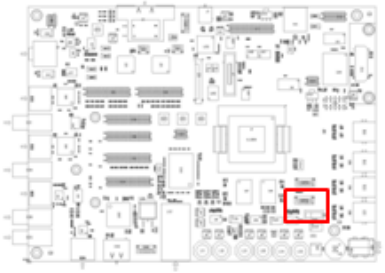
7 Board Configuration DIP Switches

The Emerald-P Promotion Board is configured using a series of DIP switches. The functionality of these groups of switches is described in the following sections.

7.1 DIP Switch SW10 (JTAG, Pin Multiplex Mode)





Part Number (Group)	Switch	Switch Name	Function
SW10 (System)	1	-	Unused (leave OFF)
	2	-	Unused (leave OFF)
	3	-	Unused (leave OFF)
	4	JTAG Select	Connected to the JTAGSEL pin of MB86R12. 0 = Normal Mode (JTAG interface not in use, default) 1 = DFT (Design For Test) Mode
	5	MPXMODE 0	Connected to the MPXMODE[0,1,2] pins of MB86R12. The functionality of these pins is somewhat complex – please refer to the section 'Pin Multiplexing' of the MB86R12 Hardware Manual. Default setting: Mode 2.
	6	MPXMODE 1	
	7	MPXMODE 2	
	8	TEST MODE	Reserved – do not change! 0 = Normal Mode (default) 1 = Test Mode

SW10 can be found on page 8 of the schematic (Rev1.7).

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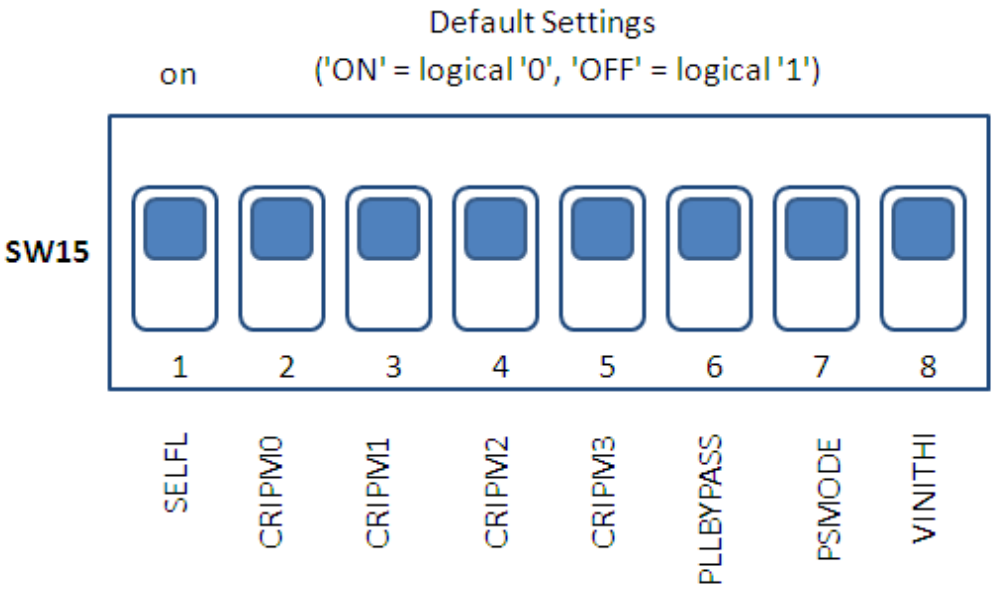
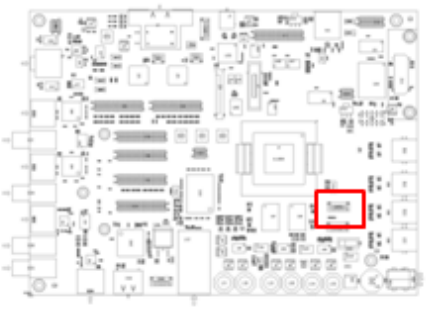
7.2 DIP Switch SW15 (Boot Flash Selection, PLL, Exception Vectors)





Part Number (Group)	Switch	Switch Name	Function
SW15 (System)	1	SELFL	Connected to the SELFL (Select Flash) pin of MB86R12 to select the memory to boot from (please refer to the 'Boot Strap' chapter of the MB86R12 Hardware Manual). Note: The boot flash device selected depends on the setting of SELFL **and** the MPXMODE 0 / MPXMODE 1 DIP switches of SW10! SELFL = 0: (default) MPXMODE[1:0] = 11: System boots from Serial flash MPXMODE[1:0] = any other setting: System boots from NOR flash SELFL = 1: MPXMODE[1:0] = 11: Reserved MPXMODE[1:0] = any other setting: System boots from NAND flash
	2	CRIPM0	The combined state of these switches sets the initial value of the SSCG feedback divider ratio (please refer to the section 'PLL Setting' of the MB86R12 Hardware Manual).
	3	CRIPM1	
	4	CRIPM2	
	5	CRIPM3	

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	6	PLLBYPASS	Configures the PLL bypass function (please refer to the section 'PLL Bypass' and 'PLL Operating Frequency' of the MB86R12 Hardware Manual). 0 = PLL is not bypassed (default) 1 = PLL is bypassed
	7	PSMODE	Configures the initial value of the PLL clock frequency divider ratio (please refer to the section 'PLL Operating Frequency' of the MB86R12 Hardware Manual). 0 = 533 MHz (default) 1 = 400 MHz Please read the important note below concerning the use of PSMODE!
	8	VINITH	Connected to the VINITHI line of the ARM core which determines the starting address of the exception vectors. 0 = exception vectors are located at 0x0000_0000 (default) 1 = exception vectors are located at 0xFFFF_0000

Important Note
(For Board Owners with an MB86R12 up to ES2 (Engineering Samples, Step 2*)
To use the JTAG interface with the Fujitsu 'Developer Suite' tool, you must set the PSMODE switch to “OFF” (= binary value 1), enabling reliable use of the JTAG interface. If you are using a different tool (e.g. GHS Integrity or RealView, then the PSMODE switch can be set to 'ON'.

* To check which ES you have, please look at the date code on the package, or check the chip's ID (register)

	ES1		ES2	
	Data code	CCID	Date Code	CCID
Emerald-P	1132	865212F1	1150	865212F2

Please check also board schematics page 8.

Summarizing the default DIP switch configuration shown above for SW10 and SW15; the board is configured to run at 533 MHz and software can be uploaded via Ethernet.

SW10 can be found on page 8 of the schematic (Rev1.7).

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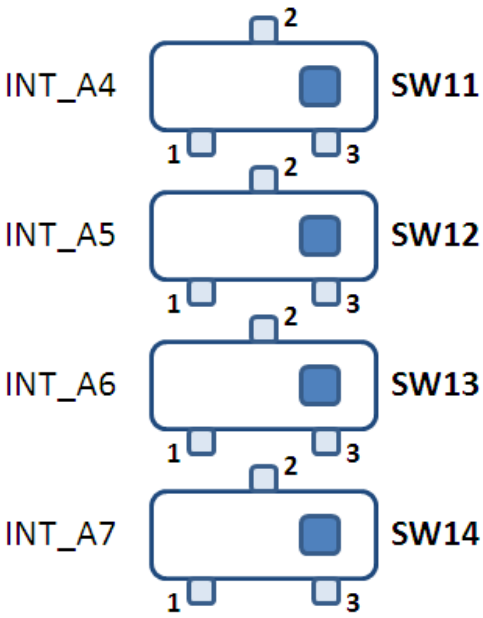
7.3 Bootstrap Options and Flash Configuration

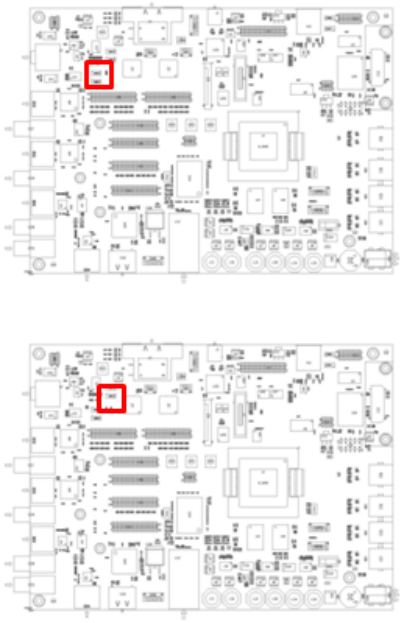
The effect of the settings made with the following DIP switches, depend on the setting of SELFL (see SW15).

- If SELFL = 0, the system boots from Serial/NOR flash and the settings for NOR flash in the table below applies.

- If SELFL = 1, the system boots from NAND provided INTA4 ... A7 are changed to 1111. Then the 2Gb, 16 bit NAND (U39) can be accessed by the bootstrap function (note that in SW10 MPXMODE[2:0] must also be set to 100 for this).

1 -2 = Logical '1'
2 -3 = Logical '0'





Part Number (Group)	Switch	Switch Name	Function
SW11 (NOR Flash)	1	INT_A4	Sets the operation mode of the serial flash device: 00 = Single Mode (default) 01 = Dual Mode 10 = Quad Mode 11 = Reserved
SW12 (NOR Flash)	1	INT_A5	
SW13 (NOR Flash)	1	INT_A6	Sets the memory type in use: 0 = Winbond W25Q16BV (default) 1 = Spansion S25FL129P
SW14 (NOR Flash)	1	INT_A7	Reserved, default = 0. (Required for NAND boot)

Note:
To change the settings of a switch, you must first remove the thin protective yellow foil on the top of the switch body.

SW11 .. 14 can be found on page 8 of the schematic (Rev1.7).

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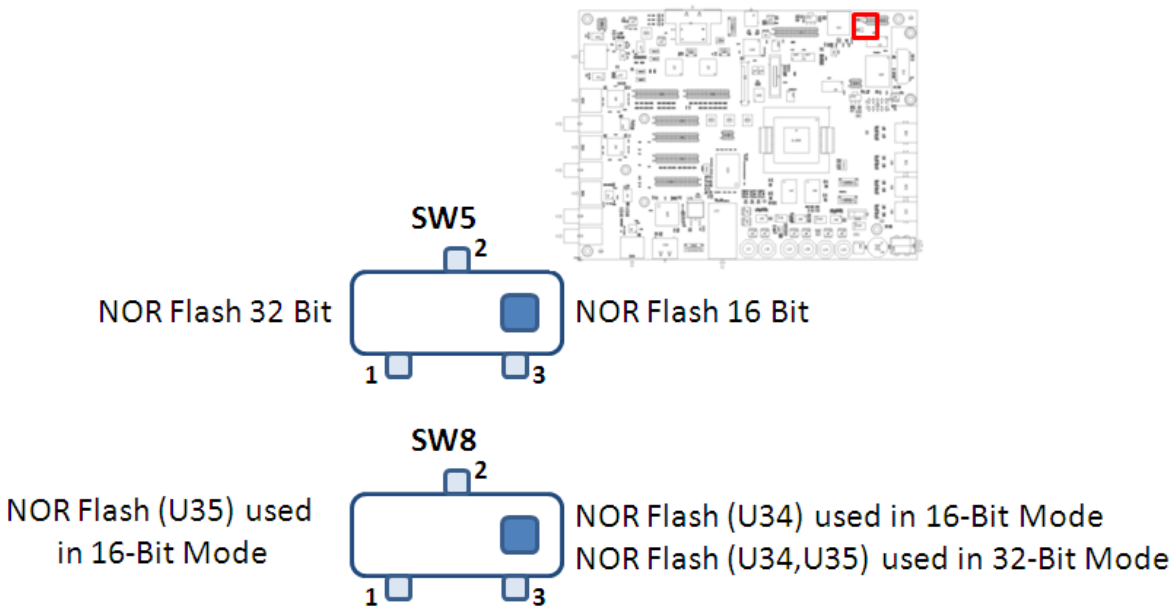

Part Number (Group)	Switch	Switch Name	Function
SW5 (NOR Flash)	1	32 Bit Mode / 16 Bit Mode	Sets the type of serial flash device: 1 - 2 = 32 Bit Flash 2 - 3 = 16 Bit Flash (default)
SW8 (NOR Flash)	1	Device/Use Mode	Interacts with SW5. Sets the use mode for components U34/U35 (see schematic) 1 - 2 = Use U35 in 16 Bit mode 2 - 3 = Use U34 in 16 bit mode / U34 + U35 in 32 Bit mode (default)

Summarizing, the default configuration of the system is:

- Boot from NOR flash
- Use component U34 in 16 Bit mode

Please check the board schematics on pages 2 and 8.

Note:
To change the settings of a switch, you must first remove the thin protective yellow foil on the top of the switch body.

SW5 can be found on page 2 of the schematic (Rev1.7).

SW8 can be found on page 14 of the schematic (Rev1.7).

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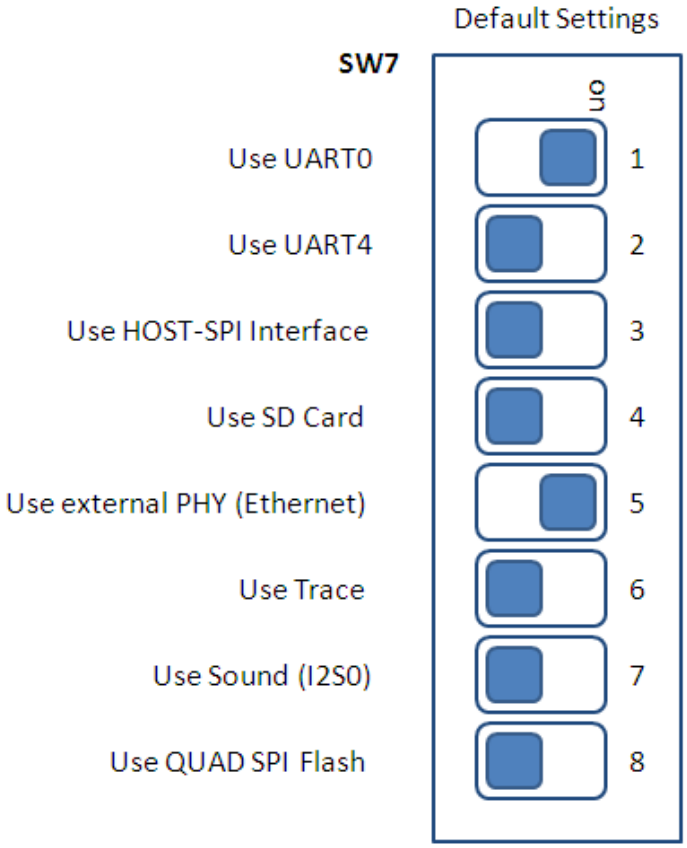
7.4 Interfaces Configuration



Part Number (Group)	Switch	Switch Name	Function
SW7 (Interfaces)	1	UART0	Enables use of UART0 (default = ON)
	2	UART4	Enables use of UART4 (default = OFF)
	3	HOST-SPI	Enables use of the Host SPI interface (default = OFF)
	4	SD CARD	Enables use of the SD Card interface (default = OFF)
	5	EXT. PHY (ETH)	Enables use of the external Ethernet PHY (default = OFF)
	6	TRACE	Enables use of the JTAG itrace interface (default = OFF)
	7	I2S0	Enables use of the I2S sound interface (default = OFF)
	8	QUAD SPI	Enables use of the Quad SPI flash memory (default = OFF)

The software supplied with the board is configured to run with this setup and the corresponding pin multiplexing configuration.

Before activating an interface – please configure the MB86R12 to use the corresponding pin multiplex group when booting. This is achieved using the U-Boot bootstrap utility, described further on in this User Manual.

Please check also board schematics page 2 and the corresponding page of the interface.

SW7 can be found on page 2 of the schematic (Rev1.7).

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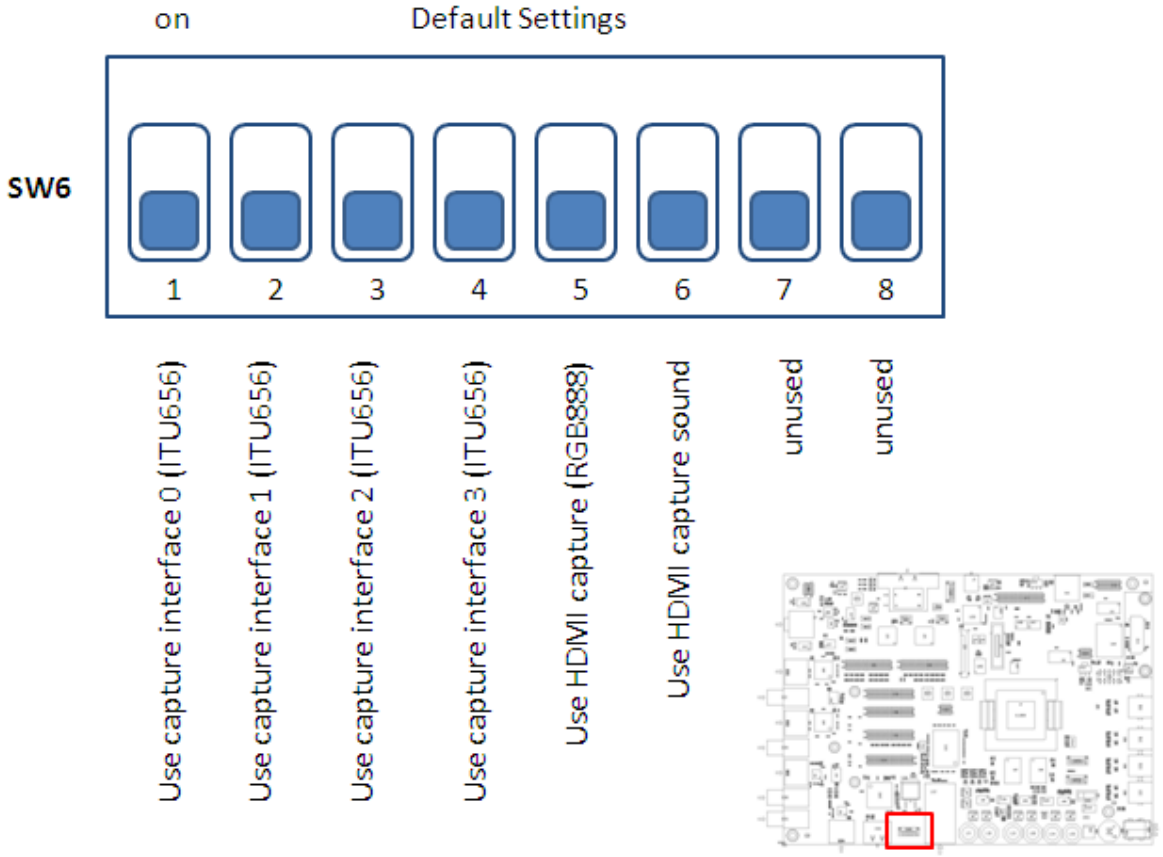

All these interfaces are deactivated by default.

Before activating an interface – please configure the MB86R12 to use the corresponding pin multiplex group when booting. This is achieved using the U-Boot bootstrap utility, described further on in this User Manual.

Please check also board schematics page 2 and the corresponding page of the interface.

SW6 can be found on page 2 of the schematic (Rev1.7).

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8 Interfaces

8.1 Display Outputs

8.1.1 Display Outputs HDMI (2 available)

The SK-86R12-01 incorporates two HDMI outputs:

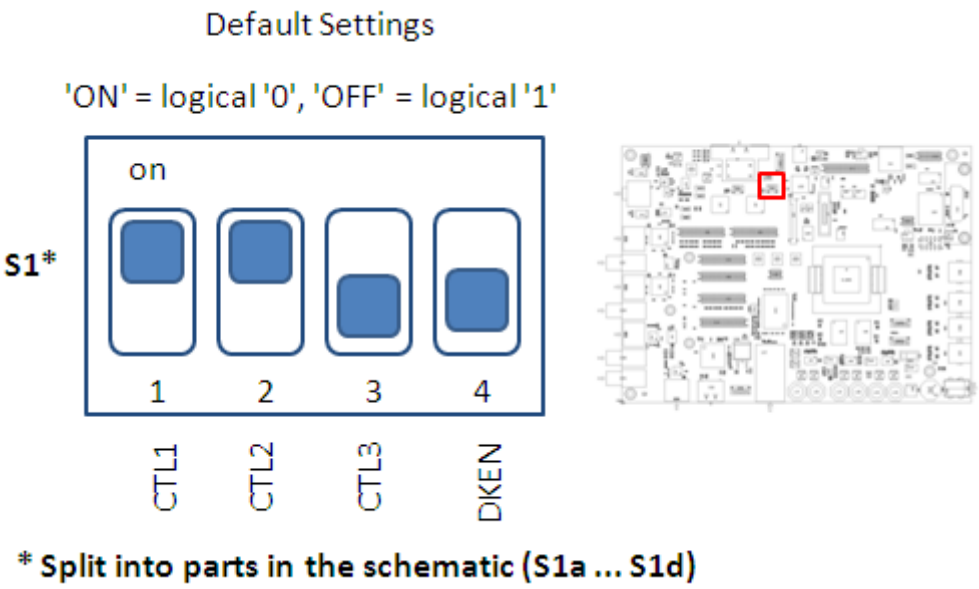
- Display 0 (this is the top connector of the stack!)
- Display 1

These Emerald-P outputs are connected to TFP410PAP (Texas Instruments) DVI transmitters (U2, U3) and use the RGB888 output format. The DVI transmitters are configured to operate without any additional software programming.

Their basic configuration is:

- Single clock
- High Voltage Swing
- 24 Bit
- Single Edge Mode
- Rising Edge Mode
- De-skewing: 0 ns

If you need to change this configuration, this can be done using switches S1 (for Display 0) and S3 (for Display 3).



*** Split into parts in the schematic (S1a ... S1d)**

S1 can be found on page 9 of the schematic (Rev1.7).

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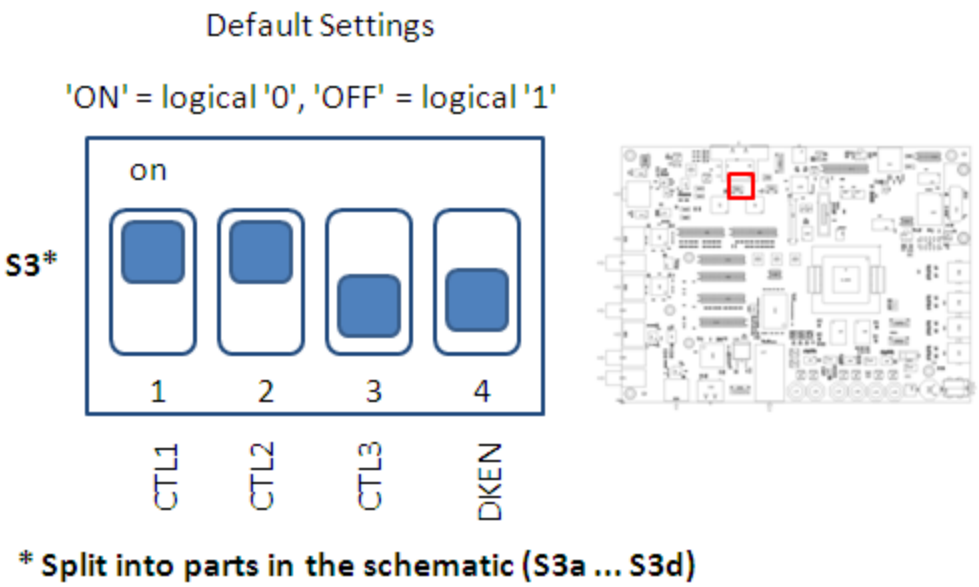


Part Number (Group)	Switch	Switch Name	Function
S1 (uses U2) S3 (uses U3)	1	CTL1	When DKEN = OFF, CTL[3:1] configure the DK de-skew inputs of the TFP410PAP device (U2/U3) in order to adjust the setup and hold times of the pixel data inputs relative to the clock input. CTL1 (default = ON = 0) CTL2 (default = ON = 0) CTL3 (default = OFF = 1) The default setting, CTL[3:1] = '100' (recommended setting, T_{CD}=±0ns).
	2	CTL2	
	3	CTL3	
	4	DKEN	Data de-skew enable (default = OFF, logical '1', i.e. enable de-skew)

Notes

- HDMI output 0 (Display 0) can only be used in conjunction with PinMuxGroup #D / MuxMode #0.
- HDMI output 1 (Display 1) can only be used in conjunction with PinMuxGroup #F / MuxMode #1

S3 can be found on page 10 of the schematic (Rev1.7).

For details on de-skewing, please refer to the datasheet of the TFP410PAP (Texas Instruments) device.

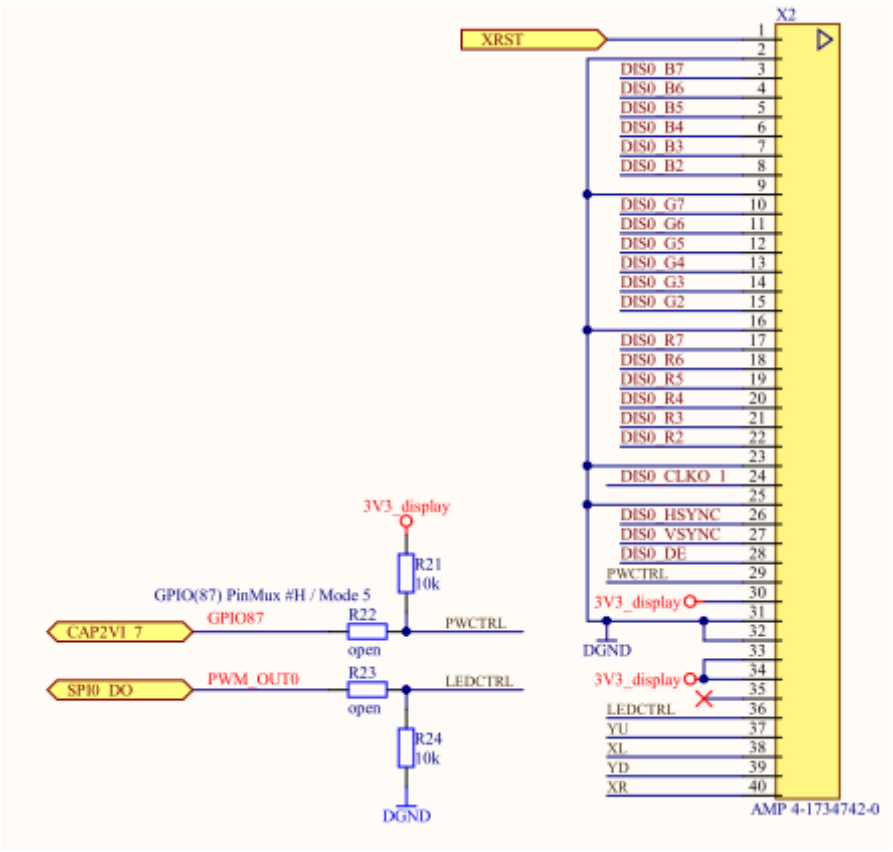
8.1.2 Display Outputs via Pin Headers (also for Glyn TFT family displays)

The SK-86R12-01 board also routes the RGB888 outputs of the three display units of MB86R12 'Emerald-P' to 1.27mm pitch pin headers.

The X2 connector on the board was designed especially for the use of displays from Glyn's EDT display family. These TFT displays can be ordered via www.glyn.de or also via Fujitsu Semiconductor Support and offer on-board touchscreens and a fixed connector layout for a wide set of different resolutions and sizes.

The CAP2VI_7 pin on the board can be used to enable the panel by software and the SPI0_DO pin can be used to dim the panel using PWM (Pulse Width Modulation), see schematics page 11 for both pins.

Before using a pin header – please configure the MB86R12 to use the corresponding pin multiplex group when booting. This is achieved using the U-Boot bootstrap utility, described further on in this User Manual.



Required Pin Multiplexing Modes

Display0 requires PinMuxGroup #D / PinMuxMode0

Display1 requires PinMuxGroup #F / PinMuxMode1

Display2 requires PinMuxGroup #I / PinMuxMode3

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8.1.3 Display Output via APIX™ TX (3GBit)

The MB86R12 'Emerald-P' chip provides three APIX TX interfaces which can be independently configured via software. The interfaces are downwards compatible to APIX1 (1GBit).

All the APIX interfaces are ESD protected and provided with Rosenberger connectors.

The Display 0 output (APIX TX0) can also utilize the 'Power over APIX' (PoA) functionality, which means that it is optionally possible to provide 12V (the V_{input} of the board) over the APIX line. This is not used by default. Please note that additional components need to be assembled for PoA operation (refer to the schematics).

For details refer to board schematics page 12 and page 13.

8.2 Video Capture Interfaces

8.2.1 Capture via APIX RX (RGB888) 3GBit Link

This mode enables the capture of data via the APIX Link (3GBit) via an internal APIX RX path.

Please refer to page 13 of the board schematics

8.2.2 Capturing via HDMI (RGB888)

To enable the capture of video data in high quality via the HDMI interface, enable switch 5 (Enable_HDMI_Capture) of SW6. The data is converted into the RGB888 format and transferred to the Capture0 interface of MB86R12 'Emerald-P'.

Required Pin Multiplexing Mode

PinMuxGroup #I, MuxMode #0 is required.

To additionally enable the capture of sound data transmitted via the HDMI interface, enable switch 6 (Enable_HDMI_Capture_Sound) of SW6. The data is then transferred to the I2S0 interface of MB86R12 'Emerald-P'.

Please refer here to page 31 of the board schematics and the AD9398 datasheet for details (see appendix).

AD9398 I^2C Write address: 0x98

AD9398 I^2C Read address: 0x99

8.2.3 Capturing Video via Pin Header X34 (RGB888)

MB86R12 'Emerald-P's Capture0 interface can be accessed via pin header X34, in order to feed a 24 bit RGB888 data stream into the device.

Required Pin Multiplexing Mode

PinMuxGroup #I, MuxMode #0 is required.

Please also refer to page 31 of the board schematics.

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8.2.4 Capturing Video (ITU656)

MB86R12 'Emerald-P' has four ITU656 video capture units. From a board design point of view (connecting components used), these are organized as two pairs:

- Capture 0 and Capture 3
- Capture 1 and Capture 2

8.2.4.1 Capture Interface 0 and 3

The following table shows the connectors used on the board.

Capture Interface	Connectors Used		Decoder
	S-Video	Cinch	
0	X24	X25	TVP5150AM1 Capture 0: I^2C (8 bit) Write address: 0xBA Capture 3: I^2C (8 bit) Write address: 0xB8
3	X26	X28	
Required Switch Settings SW6: switch 1 = ENABLE_CAPTURE_0 = ON SW6: switch 4 = ENABLE_CAPTURE_3 = ON			

8.2.4.2 Capture Interface 1 and 2

The following table shows the connectors used on the board.

Capture Interface	Connectors Used		Decoder
	S-Video	Cinch	
1	X32	X31	SAA7113H Capture 1: I^2C (8 bit) Write address: 0x4A Capture 2: I^2C (8 bit) Write address: 0x48
2	X30	X29	
Required Switch Settings SW6: switch 2 = ENABLE_CAPTURE_1 = ON SW6: switch 3 = ENABLE_CAPTURE_2 = ON			

Required Pin Multiplexing Mode (for all Video Capture units)

PinMuxGroups #H+I, MuxMode #0 is required.

The TVP5150AM1 and SAA7113H decoders must be programmed correctly via I2C (e.g. to select the input signal S-Video or CVBS*).

* The board is supplied for use with S-Video signals. For CVBS input, board must be modified (components removed). Please contact Fujitsu support for details and consult Texas Instruments Application Report 'TVP5150AM1 Anti-Aliasing Filters' (document SLEA087A, 2010).

Please check the datasheet of the respective device for details.

Please refer to page 29 of the board schematics for details.

8.2.5 Video Capture for 360° Wrap Around View (using all 4 capture units)

If you have purchased the SK86R12-01 'Emerald-P' Promotion Board as a part of the 360° Wrap Around View package, then you will be using all four video capture units simultaneously (whether 4x ITU656 or 4x digital input). This package includes an additional add-on board ('Add-on 360° Wrap Around View board') which has an X33 connector, with the inputs for all four capture units, as well as SPI0 , UART0, GPIOs and I^2C pins to control the connected cameras. Please refer to Chapter 8 for details on the 360° WAV product.

8.3 Ethernet (using internal MAC, external PHY)

The SK86R12-01 Promotion Board has an RJ45 connector (X17) which is used to connect the board to an Ethernet network (this will typically be a small local network on your workplace, used for development work).

By default, the board operates in a 100MBit mode, although the MB86R12 has a built-in 1GB MAC. However, the board itself can not support the faster link because the copper track routing on the PCB also has to take the multiplexed use of the Ethernet pins into account, and this makes full speed usage impossible.

To use the Ethernet functionality, please set switch 5 of SW7 to ON (Enable_ext_PHY).

Required Pin Multiplexing Mode

PinMuxGroup #I, MuxMode #1 or 2 are required to use the internal MAC and PHY units for Ethernet communication.

Please refer to page 18 of the board schematics for details.

Important Note (Ethernet Interface not available in WAV Configuration)

Please note that due to the pin multiplexing configuration that is required to use the hardware in 360° Wrap Around View mode, the Ethernet Interface is **not available!** Consider using a USB-Network adapter as an alternative.

8.4 USB Host Interface

The SK86R12-01 Promotion Board has a USB connector (X23) that can be used to connect external hardware (USB mouse, USB keyboard, USB hub, USB stick etc.).

The USB interface can always be used and is independent of any pin multiplexing settings.

Please refer to page 20 of the board schematics for details

8.5 JTAG / 16 Bit Trace Interface

The SK86R12-01 Promotion Board incorporates a JTAG / 16 Bit Trace debugging interface to enable fast and easy access to the register set of MB86R12 'Emerald-P'.

To use this interface, connect the 38 pin MICTOR connector of your debugger to connector J2 on the PCB.

Note that Fujitsu's GDC Support Team can also deliver an adapter for standard 20 pin 2.54mm pitch connectors (e.g. for Realview). Contact your Fujitsu sales representative if you require such an adapter.

Required Pin Multiplexing Mode

The JTAG interface is enabled by default and a specific pin multiplexing setup is not required for use.

PinMuxGroup #B, MuxMode #3 is required to use the 16 Bit Trace interface.

Switch 6 of SW7 must be set to ON for use of the Trace interface (Enable_Trace).

Please refer to page 22 of the board schematics for details

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8.6 Mini-USB to RS232 / HOST SPI / I²C Interface

The SK86R12-01 Promotion Board has a bus-powered FTDI chip that provides the following interfaces via virtual COM ports:

- two RS232 ports
- one I²C interface
- one HOST SPI port

When connected via USB, Windows automatically recognizes* the FTDI hardware as follows:

- 'USB Serial Converter A': can be used as the HOST SPI interface
- 'USB Serial Converter B': can be used as an I²C interface direct to devices (see below)
- 'USB Serial Converter C': can be used as the UART0 interface
- 'USB Serial Converter D': can be used as the UART4 interface

* If you are using Windows XP, you will need to install the FTDI drivers manually first (see Quick Start chapter).

8.6.1 HOST SPI Interface

The HOST SPI interface can be used to access the MB86R12 'Emerald-P' device. Fujitsu GDC Studio, is a complete development tool suite that includes a driver for this purpose. Check this link for details on Fujitsu Developer Suite:

http://www.fujitsu.com/emea/services/microelectronics/gdc/swtools/fj-developer-suite.html

Required Pin Multiplexing Mode

PinMuxGroup #B, MuxMode #1 is required to use the HOST SPI interface.

Switch 3 of SW7 must be set to ON to use the HOST SPI interface (Enable_SPI_Host).

8.6.2 RS232 (UART) Ports

The RS232 ports are connected to Emerald-P's UART0 and UART4 and will be detected if a mini-USB cable is used to connect J1 (mini-USB) to a PC.

To enable the use of the UART ports (e.g. for a terminal connection) the following settings must be made on the board:

Switch 1 of SW7 must be set to ON (default) for UART0 (Enable_UART0) (default setting)

Switch 2 of SW7 must be set to ON (default) for UART4 (Enable_UART4)

To use a RS232 communication port, please make sure your terminal software (e.g. Tera Term - http://ttssh2.sourceforge.jp) is configured with the following settings:

- Baud rate: 115.200 bps
- Data: 8 bits
- Stop bit: 1 bit
- Parity: none
- Flow Control: none

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8.6.3 I²C Interface

It is possible to use this I²C interface (available on connector X10) to directly program I²C devices on the board, although this is normally handled by the MB86R12 'Emerald-P' device.

If you wish to use this interface for test or debugging purposes, you must first obtain Third Party software from Future Technology Devices International Ltd. (FTDI) .

Please visit the FTDI webpage for more information. http://www.ftdichip.com/ and refer to Application Note AN_177 'User Guide For libMPSSE – I2C'.

Furthermore, you will need to modify the PCB (add 0Ω resistors at R268 and R269) and disable the I²C unit of MB86R12 'Emerald-P'.

Please refer to page 23 of the board schematics for details

8.7 CAN Interface

The SK86R12-01 Promotion Board incorporates a CAN bus connector (X16).

If you own or have access to the Jade-L Starterkit (SK-86R03), then you can use the adapter supplied with this to connect a 9-pin sub-D connector (10-pin pin header to 9-pin sub-D adapter).

Please refer to page 24 of the board schematics for details.

8.8 MediaLB Interface

The SK86R12-01 Promotion Board incorporates an SMSC MOST module bus connector (X12).

This connector can be used directly with SMSC PHY+ Modules, available for different speeds (MOST 25, 50).

For more information please check the SMSC website:

http://www.smsc-ais.com/AIS/content/view/852/818/

The MediaLB interface is also available on a seperate connector (X14).

Required Pin Multiplexing Mode

PinMuxGroup #G, MuxMode #0 is required to use the MediaLB interface.

Please refer to page 24 of the board schematics for details.

8.9 SD Card Interface

The SK86R12-01 Promotion Board provides a SD Card interface with a card reader (X16).

Switch 4 of SW7 must be set to ON to use this interface (ENABLE_SD_CARD).

Required Pin Multiplexing Mode

PinMuxGroup #F, MuxMode #0 is required to use the SD Card interface.

Please refer to page 25 of the board schematics for details.

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8.10 Sound

An external sound codec (WM8976) is integrated on the SK86R12-01 Promotion Board and connects to the I2S0 interface of the MB86R12 'Emerald-P'. The codec can be programmed via I2C. Please check the device's datasheet for details (see Appendix).

Required Pin Multiplexing Mode

PinMuxGroup #F, MuxMode #0 or #4 is required to use the sound interface.

Connector X7 has LINE_INPUT and LINE_OUTPUT jackplug connections (both are stereo).

Set switch 7 of SW7 to ON in order to use the sound interface (ENABLE_I2S0_SOUND).

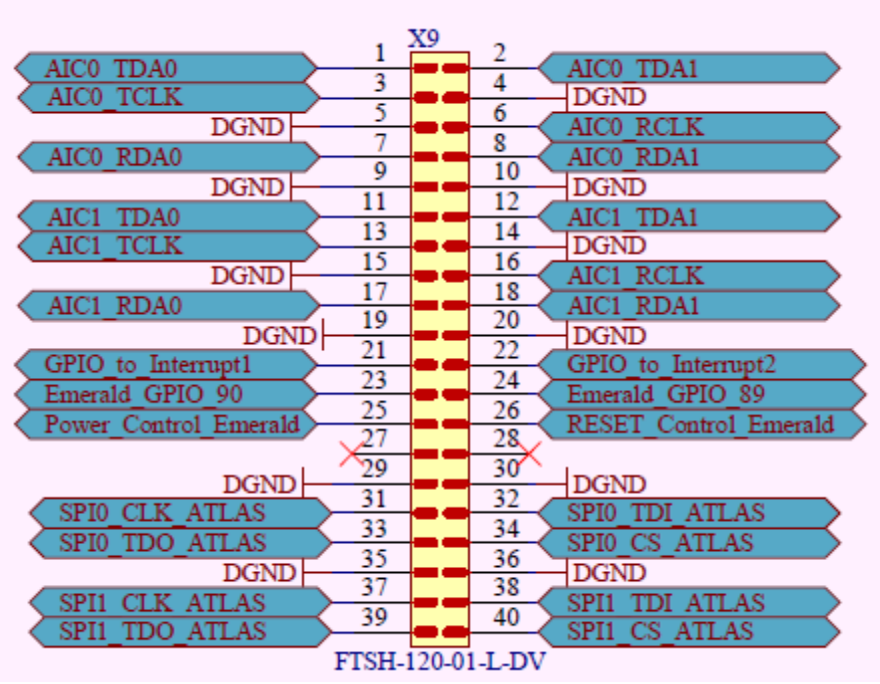
Please refer to page 26 on the board schematics for details.

8.11 AIC / IPC (to Atlas)

The SK86R12-01 Promotion Board was also designed for deveopment work with Fujitsu's MB9DF126 'Atlas' MCU device. For details, follow this link:
http://mcu.emea.fujitsu.com/mcu_product/detail/MB9DF126PMC.htm

The AIC/IPC (Automotive Inter Connect / Inter Process Connect) interface of the SK86R12-01 Promotion Board is identical to that of the Atlas Starterkits, but it can be used also with other MCUs.

The diagram below shows the pinning of connector X9 (AIC/IPC).



Short pin description:

- AICxx_TDxx : serial bus, transmit direction
- AICxx_RDxx : serial bus, receive direction
- AICxx_CLK : serial bus, clock
- GPIO_to_Interruptxx : Atlas can use GPIOs to trigger interrupts on Emerald
- Emerald_GPIO_xx: two GPIOs from Emerald that can be used outside
- SPI0_xxxxx : SPI0 interface from Atlas
- SPI1_xxxxx : SPI1 interface from Atlas
- Power_Control_Emerald: soft start for Emerald board (also see section 4), HIGH starts up the board

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Required Pin Multiplexing Mode

PinMuxGroup #F, MuxMode #2 is required to use the AIC/IPC interface.

Please refer to page 27 of the board schematics for details.

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9 Power Supply

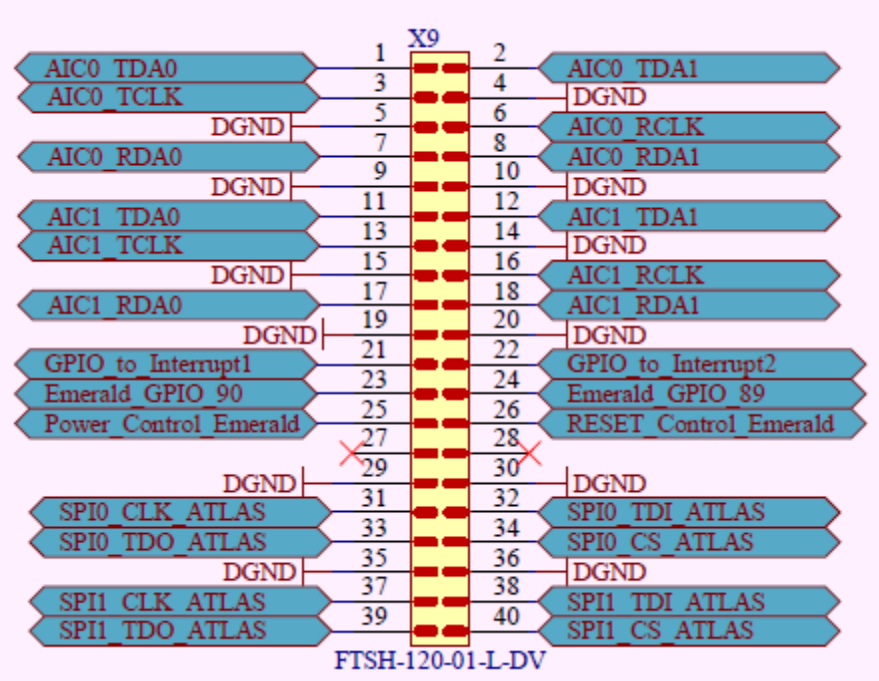
The SK86R12-01 Promotion Board requires an external power adapter to supply an input voltage in the range of 9V ... 18VDC. The current consumption of the board in operation is approximately 1.5A.

The board generates various supply voltages (1V2, 1V5, 1V8, 3V3, 5V), required to power the MB86R12 and interface devices on the baseboard. The power supplies are designed to deliver a current of up to 4A each. A seperate 5V supply (max. 4A) is available for external use, e.g. for external cameras, the '360° WAV add-on board' (for digital cameras), etc.

The external power input is fused and protected against reverse polarity.

9.1 External Startup

It is possible to start up the SK86R12-01 Promotion Board using an external control (e.g. coming from an Atlas Starterkit). Pin 25 of connector X9 provides this functionality, whereby a HIGH signal level triggers a power up sequence on the SK86R12-01 Promotion Board.



Please check page 27 of the board schematic.

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10 Memory

10.1 DDR3 (U27, U28)

The SK86R12-01 Promotion Board incorporates two Micron MT41J128M16HA-15E DDR3 memory devices, each with 2GBit (= 256 MByte). These devices can attain data rates up to 1,333 MT/s (Million Transfers per second) and are organized as 16Mbit x 16 x 8 banks.

The correct configuration of the memory devices is handled by the U-Boot utility.

Please refer to page 16 of the board schematics for details.

10.2 QUAD SPI Flash (U40)

The SK86R12-01 Promotion Board incorporates a QUAD SPI flash device from Spansion (S25FL129P0XNF100) which offers a capacity of 128MBit (16 Mbyte). It is also possible to boot the system from this flash (provided the following setup exists).

Switch 8 of SW7 must be set ON to use the SPI flash (ENABLE_QUAD_SPI_FLASH).

Required Pin Multiplexing Mode

PinMuxGroup #A, MuxMode #1 is required to use the QUAD SPI flash.

Please refer to the specification of the memory device for programming details.

Please refer to page 17 of the board schematics for details.

10.3 NAND Flash (U39)

The SK86R12-01 Promotion Board incorporates a 2GBit NAND Flash device (with 1-Bit ECC) from Micron (MT29F2G16ABAEAWP-IT) which offers 16 bit data lines. In the default setup (the device is not used as a boot device), the memory is selected via Chip Select signal XCS1 (default) over 0Ω resistor R344. However, if you wish to boot from the NAND, you must assemble R340 (also a 0Ω resistor) and use Chip Select signal XCS0 (the MB86R12 always boots from XCS0).

Please refer to the datasheet of this device for details on programming.

Please refer to page 17 of the board schematics for details.

10.4 NOR Flash (U34, U35)

The Emerald-P Promotion Board incorporates two 1GBit NOR flash devices from Micron (type: JS28F00AM29EWL).

Use Chip Select XCS0 to access the NOR flash chip. Normally, the memory will be accessed in either 16 bit or 32 bit mode (the bus is designed to handle both modes) but it is also possible to address the two devices separately in 16 bit mode, making it possible to reserve one device for data that is not touched (a safe backup system) while the other device is being reprogrammed and used. In the event of problems, this would ensure that it is always possible to boot from the backup device.

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10.4.1 Overview of possible Use Configurations

16 bit access (U34 active)

- Set SW5 to switch position 2 – 3 (default)
- Set SW8 to switch position 2 – 3 (default)

The first NOR device (U34) only will be used in 16 bit mode. U35 is then not used and could be used for system recovery if booting from U34 fails.

16 bit access (U35 active)

- Set SW5 to switch position 2 – 3 (default)
- Set SW8 to switch position 1 – 2

The second NOR device (U35) only will be used in 16 bit mode.

32 bit access (U34 + U35 active)

- Set SW5 to switch position 1 – 2
- Set SW8 to switch position 2 – 3

Both devices will be activated using the XCS0 signal.

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11 360°Wrap Around View (WAV) System

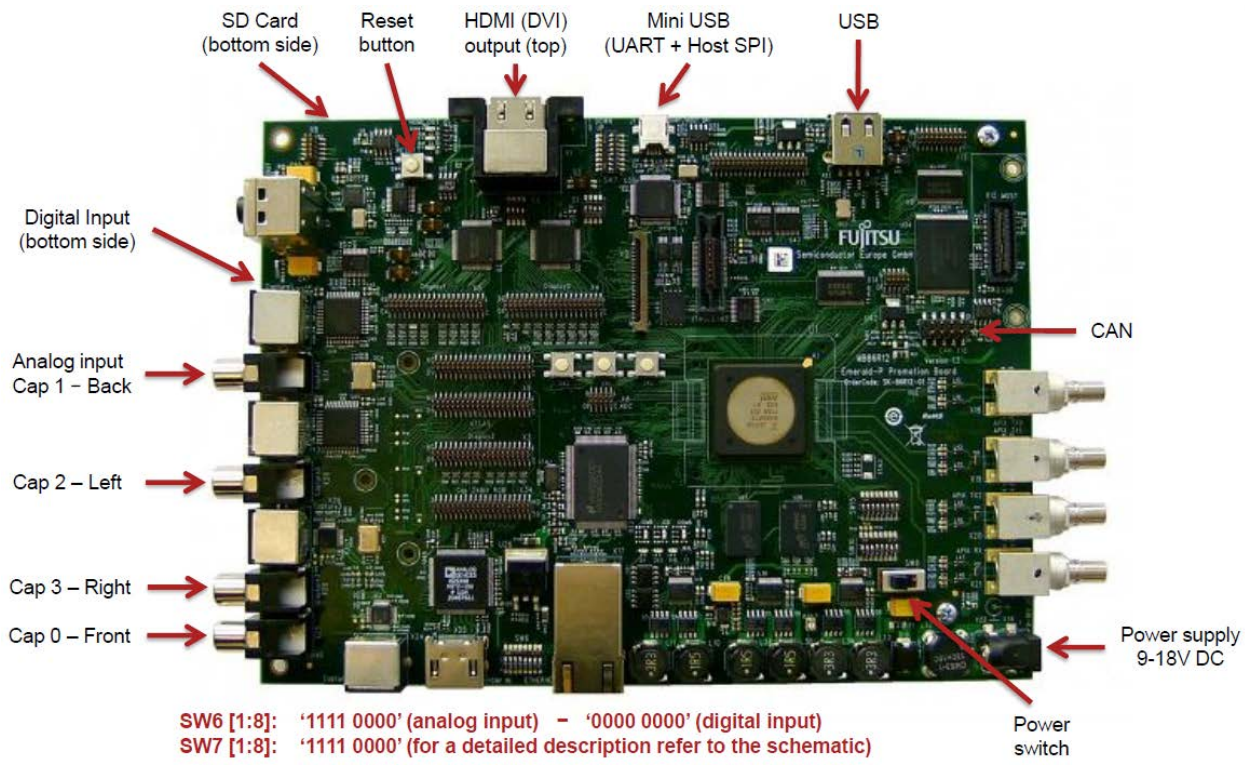


Figure 11-1: Fully assembled SK-86R12-01 Board for WAV

The SK86R12-01 Promotion Board is also supplied as a part of the 360° Wrap Around View product. In this configuration, the (modified) board is supplied together with four video capture cameras and its default switch configuration is different (to match the application's requirements).

WAV Current Scope of Delivery (analog cameras)

- 1x Emerald-P Promotion Board (SK-86R12-01), with additional cinch connectors to connect the board to the output ports of the camera adapter box
- 1x Camera Adapter Box
- 4x Cameras (ND-BC100II)
- All cables required to set up the system
- Calibration Markers
- DVD and USB stick with documentation, software and tools

- Optional Extra (not included in delivery, please order seperately):
  8" LCD Monitor (800x600)

Important Note (Ethernet Interface not available in WAV Configuration)

Please note that due to the pin multiplexing configuration that is required to use the hardware in 360° Wrap Around View mode, the Ethernet Interface is **not available!** Consider using a USB-Network adapter as an alternative.

U-Boot Modifications Required for WAV use
(Please check these settings if you install a Linux BSP update from the Fujitsu website!)

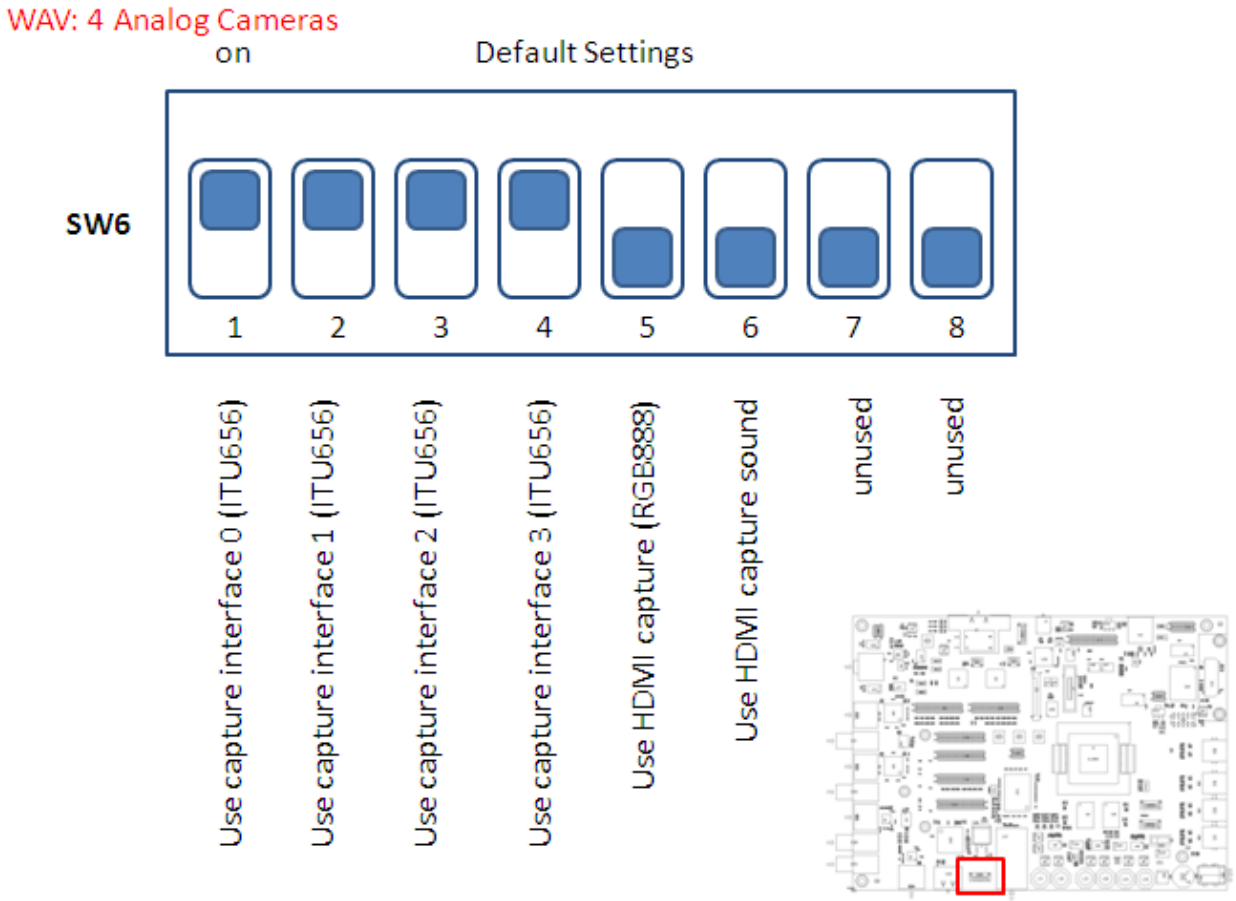
- pinmux=80000000
- pinmux2=00000168
- tcon_pinctrl=93
- cpumem=mem=256M
- gpumem=gpumem=256M

SK86R12-01 Promotion Board Layout Modifications

Please note that the SK-86R12-01 board is supplied in a slightly modified form, when delivered as a part of the 360° Wrap Around View product package. The differences are:

- ADC filter configuration
- Additional cinch connectors are mounted:
  - X25 [capture 0]
  - X31 [capture 1]
  - X29 [capture 2]
  - X28 [capture 3]

SK86R12-01 Promotion Board Switch Configuration



Please note that this setup requires an additional add-on board (SK-86R12-WAV01).

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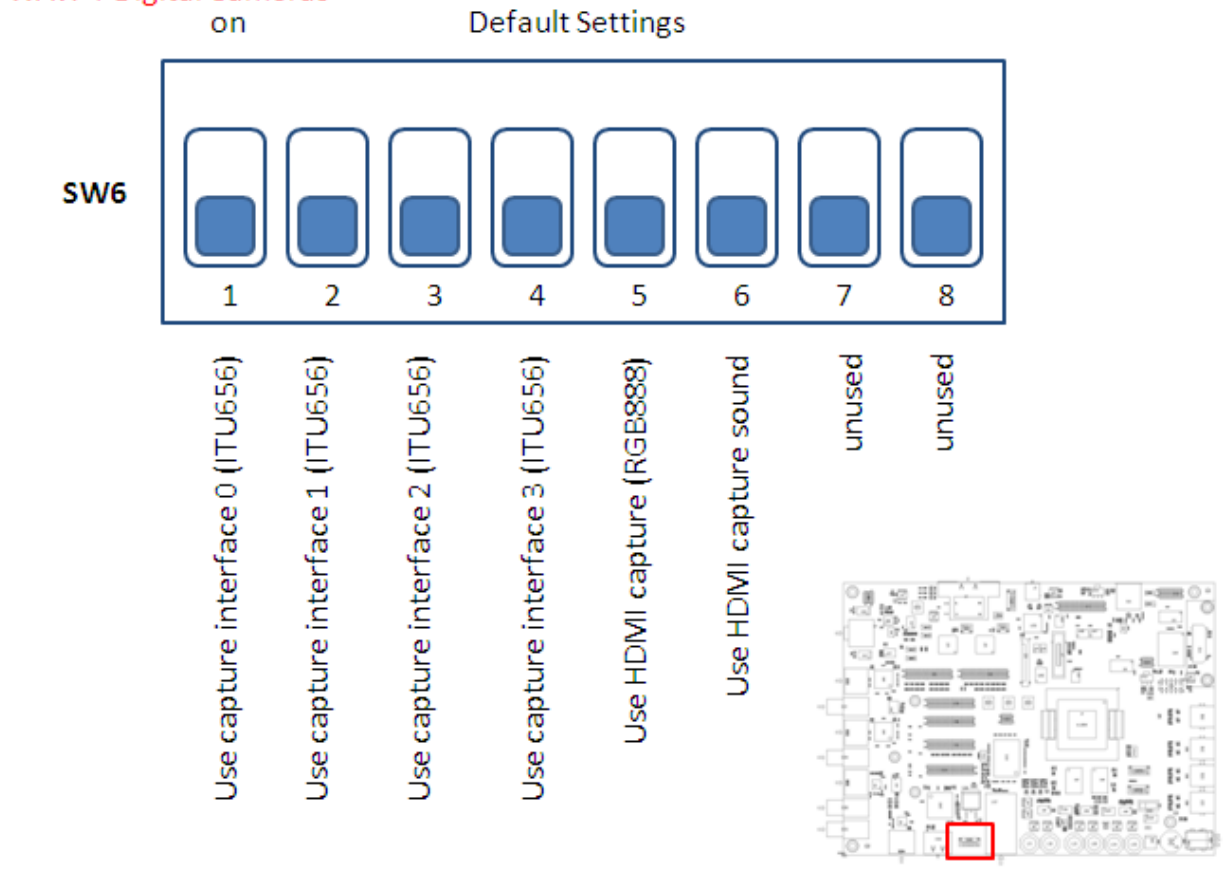
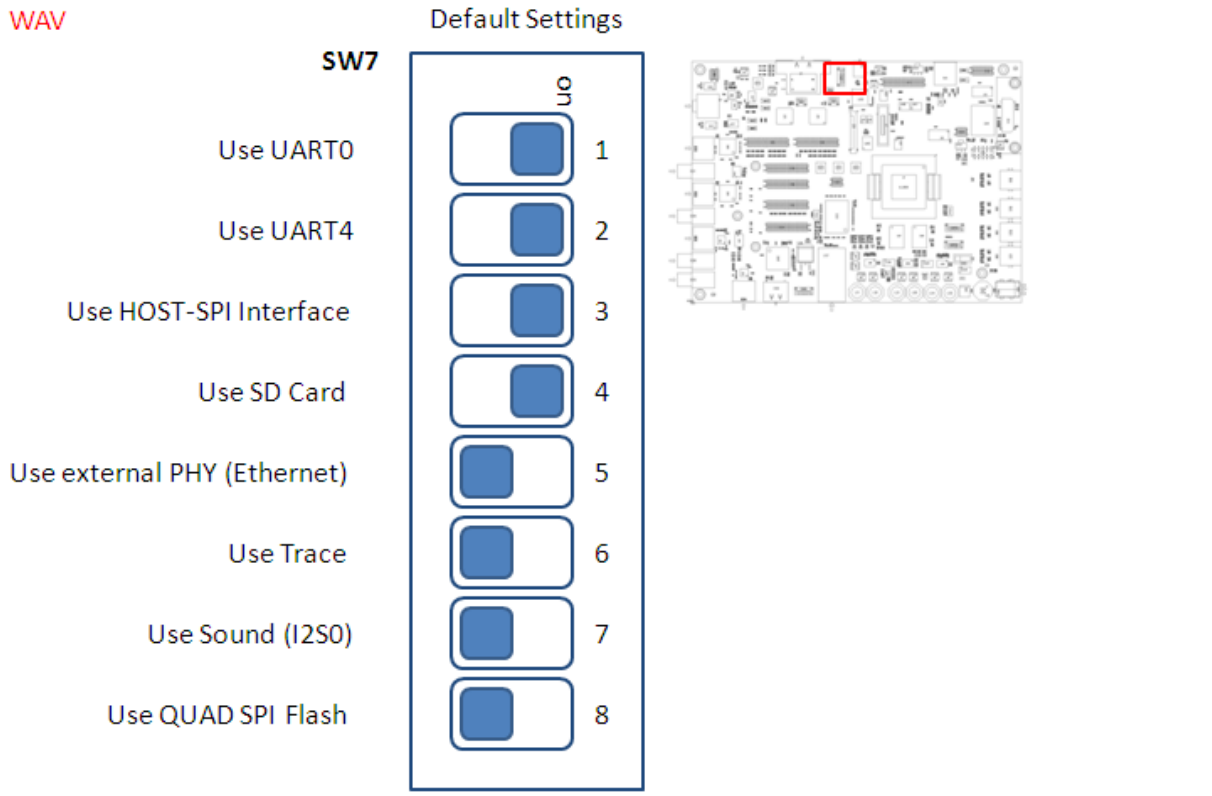
WAV: 4 Digital Cameras



WAV



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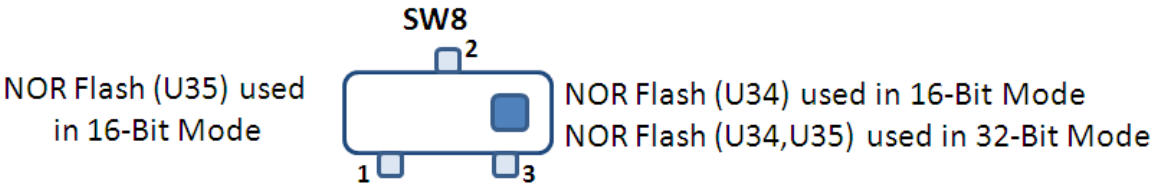
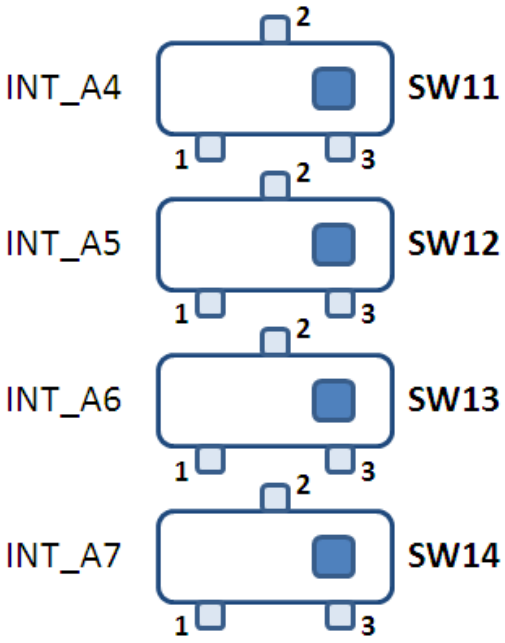
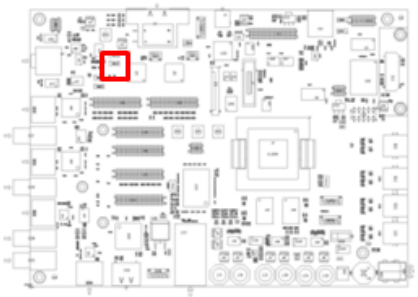
WAV



WAV

1 -2 = Logical '1'
2 -3 = Logical '0'





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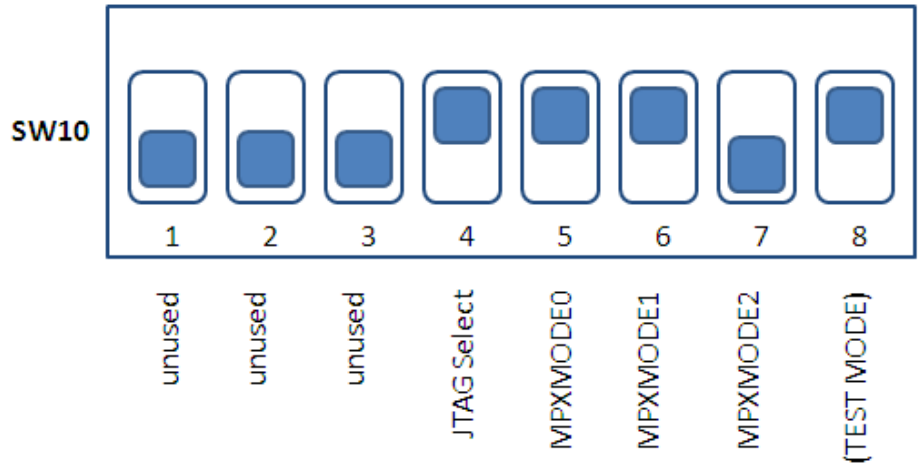
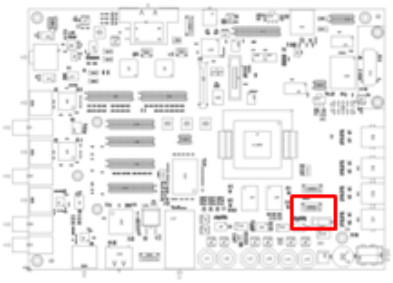
WAV

Default Settings

on ('ON' = logical '0', 'OFF' = logical '1')

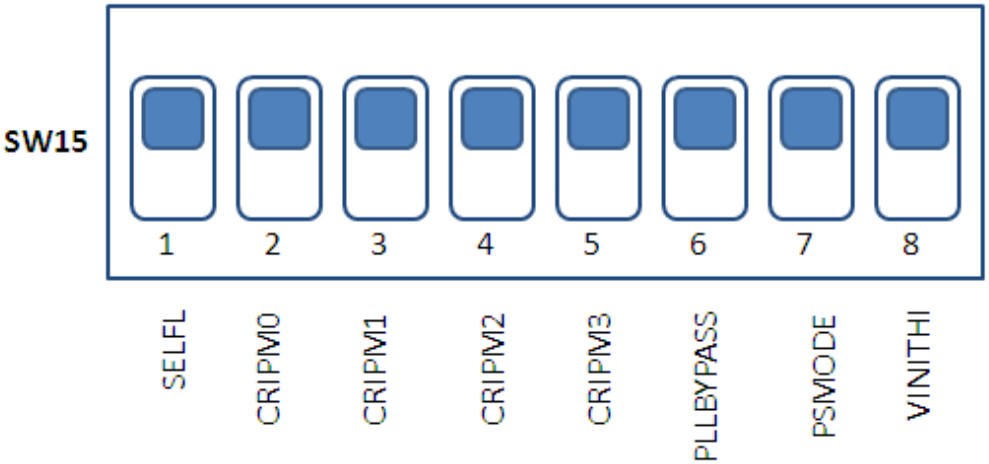


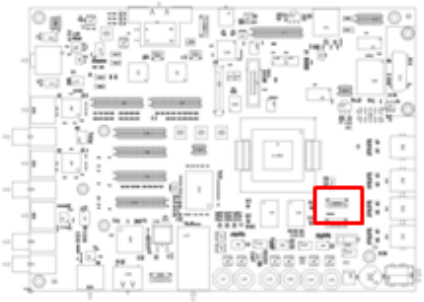


WAV

Default Settings

on ('ON' = logical '0', 'OFF' = logical '1')





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Connectors Used

- Display Out 0 (upper HDMI Connector)
- MiniUSB for UART0
- CAN Adapter cable, connected to X16
- Camera Connectors X25, X28, X29, X31 (Cinch Connectors)

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12 Appendix

12.1 Literature and References Used

- Emerald-P Promotion Board Schematics:
  http://www.fujitsu.com/downloads/MICRO/fme/displaycontrollers/sch-sk-86r12-01-rev1-5.pdf
- Datasheet SAA7113H Video Processor:
  http://www.nxp.com/pip/SAA7113H.html
- Datasheet Wolfson WM8976 Sound Codec:
  http://www.wolfsonmicro.com/products/codecs/WM8976/
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- Datasheet External PHY DP83865DVH:
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- Datasheet Spansion QUAD SPI Flash S25FL129P0XNF100:
  http://www.spansion.com
- Datasheet NAND Flash Micron MT29F2G16AADWP-ET:
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- Datasheet FTDI FT4232HL Chip :
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- Datasheet Video Processor TVP5150AM:
  http://www.ti.com/product/tvp5150

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12.2 Figures

Figure 3-1: System Overview *10*
Figure 4-1: Console output *12*
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Figure 6-1: Standard Board Layout/Assembly *14*
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